END SURFACE STRUCTURE OF A HEAT PIPE FOR CONTACT WITH A HEAT SOURCE

BACKGROUND OF THE INVENTION

The present invention relates in general to an end surface structure of a heat pipe, and more particularly, to an end surface structure of a heat pipe having a large gauge, which is used to be contacted with a heat source for dissipation.

Having the characteristics of high thermal conductivity, fast thermal conduction, light weight, non-movable components and simple structure, the heat pipes are able to deliver large amount of heat without consuming electricity, and are therefore commonly used in the market.

Figure 1 illustrates a heat pipe 1a having one end capably to be contacted with a heat source for dissipation. The heat pipe 1a includes a lid 12a, and a pipe member 10a with a close end and an open end. A wick structure 11a is attached to the inner wall of the pipe member 10a and the working fluid will be filled in the pipe member 10a thereafter. The wick structure 11a provides capillary force to transport the working fluid filled in the pipe member 1a. The lid 12a is provided to cover on the open end of the pipe member 1a. The lid 12a has a filling tube 120a for the working fluid to be filled into the pipe member 1a thereby. Moreover, after some further process such as vacuuming, the pipe member 10a is sealed with a sealing structure 121a on the filling tube 120a by the application of tin or soldering.

The above heat pipe 1a has a large gauge and provides a flat surface 100a to be contacted with the heat source. Therefore, in application, the heat pipe 1a can stand on the heat source.

However, normally this kind of heat pipe 1a is fabricated by forging process. Therefore, the fabrication is more difficult with higher cost and is impossible for mass production. Furthermore, the heat pipe 1a with longer pipe member 10a may not be fabricated by forging. Such that, the large gauge heat pipe is still highly demanded in market.

Therefore, there exist inconvenience and drawbacks for practically application of

the above-mentioned heat pipe. There is thus a substantial need to provide an improved end surface structure of heat pipe that resolves the above drawbacks and can be used more conveniently and practically.

SUMMARY OF THE INVENTION

The present invention provides an end surface structure of a heat pipe that can be easily fabricated and suitable for mass production.

The end surface structure provided by the present invention includes a pipe member, a lid and a base. The pipe member is a hollow tube with a wick structure attached to an inner wall thereof. The pipe member includes two opposing open ends. The lid is closely covered on one open end. The base provides an interlocking member including a flange fitly embracing the pipe member to receive the other open end of the pipe member thereinside. Moreover, the thickness of the flange is not larger than the thickness of pipe member at the open end received in the interlocking member. When the base is fitted with the pipe member at the open end, a welding process is performed to permanently connect them together. In the welding process, the flange of the interlocking member is enforced to be liquefied first and is liquefied more than the pipe member at the open end. As such, it can ensure that the pipe member is prevented from being damaged during the welding process, and an effective production can be obtained.

These and other objectives of the present invention will become obvious to those of ordinary skill in the art after reading the following detailed description of preferred embodiments.

It is to be understood that both the foregoing general description and the following detailed description are exemplary, and are intended to provide further explanation of the invention as claimed.

BRIEF DESCRIPTION OF ACCOMPANIED DRAWINGS

The above objects and advantages of the present invention will be become more apparent by describing in detail exemplary embodiments thereof with reference to the attached drawings in which:

Figure 1 illustrates a cross sectional view of a conventional heat pipe;

Figure 2 shows an exploded view of a heat pipe provided by the present invention;

Figure 3 is a cross sectional view of the assembled heat pipe;

Figure 4 is a cross sectional view of the heat pipe after a welding process;

Figure 5 shows a local enlarged view of the portion A as shown in Figure 4; and

Figure 6 shows a cross sectional view of a heat pipe according to another preferred embodiment.

DETAILED DESCRIPTION OF EMBODIMENT

Reference will now be made in detail to the preferred embodiments of the present invention, examples of which are illustrated in the accompanying drawings. Wherever possible, the same reference numbers are used in the drawings and the description to refer to the same or like parts.

As shown in Figures 2 and 3, the exploded view and cross sectional view of a heat pipe provided by the present invention are illustrated. As shown, the heat pipe 1 includes a pipe member 10, a lid 11 and a base 12.

The pipe member 10 is preferably a cylindrical hollow tube with two open ends 100 and 101. A wick structure 13 is attached to an inner wall of the pipe member 10. The lid 11 includes a thin plate fabricated by press, for example, and is applied to seal the pipe member 10 at one open end 100 by closely covering thereon. The other open end 101 is then sealed by the base 12, and the wick structure 13 is further extended to attach on the inside surface (opposite to the outside surface 120) of the base 12. In addition, the lid 11 has a through hole 110 for a filling tube 111 being mounted therein, such that the working fluid can be filled inside the pipe member 10 thereby. After some further process such as vacuuming, the heat pipe 1 is sealed with a sealing structure 112 (as shown in Figure 4) on the filling tube 113 by the application of tin or soldering. Furthermore, the base 12 provides the outside surface 120 which is a flat surface for contact with a heat source. Therefore, the heat pipe 1 with an end surface to be contacted with the heat source for dissipation is obtained.

In the present invention, the pipe member 10 is permanently connected with the base12 by a welding process after interlocking them together. The base 12 includes an interlocking member 121 for receiving the open end 101 of the pipe member 10. The interlocking member 121 includes a flange to embrace the received open end 101 of the pipe member 10, which is made by forming a circular recess 123 adjacently inside the flange and an annular slot 122 adjacently outside the flange. As the shape and the size of the flange of the interlocking member 121 is fitted to the exterior surface of the open end 101, the pipe member 10 is embedded in the circular recess 123 under an engagement with the interlocking member 121. Therefore, the interlocking member 121 positions the base 12 along the axial and radial direction of the pipe member 10. Moreover, the thickness b of the flange of the interlocking member 121 is not larger than the thickness B of the wall (side surface) of the pipe member 10 at the open end 101.

As shown in Figures 4 and 5, while the base 12 is interlocked with the pipe member 10 at the open end 101, a welding process is applied. As the thickness b of the flange of the interlocking member 121 is not larger than the thickness B of the wall of the pipe member 10 at the open end 101, the flange of the interlocking member 121 is enforced to be liquefied first, and is liquefied more than the wall of the pipe member 10 at the open end 101. As such, it can ensure that the wall of the pipe member 10 at the open end 101 will not be damage due to the fusion in the welding process. The interlocking 121 does not only provide axial and radial positioning of the base 12 to the pipe member 10, but the flange of the interlocking member 121 also serve as fusion region between the pipe member 10 and the base 12 to obtain a good welding effect. Thereby, the heat pipe 1 can be fabricated by mass production with enhanced yield rate.

Finally, as shown in Figure 6, it illustrates another preferred embodiment of the present invention. In this preferred embodiment, the annular slot 122 is extended outwardly to the whole base 12 to obtain a more uniform structure of the base 12. As such, the residual stress and heat deformation after the welding process is reduced. Therefore, the structure of heat pipe 1 can be enhanced.

While the present invention has been particularly shown and described with

reference to preferred embodiments thereof, it will be understood by those of ordinary skill in the art the various changes in form and details may be made therein without departing from the spirit and scope of the present invention as defined by the appended claims.